

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

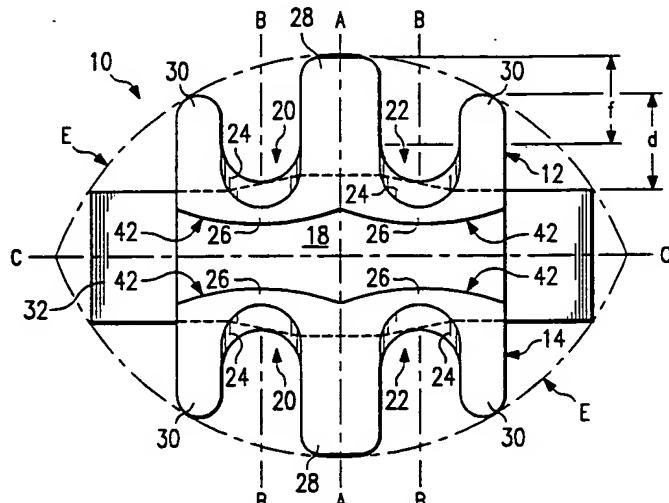
IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| | | | |
|--|--|---|--|
| (51) International Patent Classification ⁵ : A61C 3/00 | | A1 | (11) International Publication Number: WO 92/20296 (43) International Publication Date: 26 November 1992 (26.11.92) |
| <p>(21) International Application Number: PCT/US92/04263</p> <p>(22) International Filing Date: 20 May 1992 (20.05.92)</p> <p>(30) Priority data: 702,943 20 May 1991 (20.05.91) US</p> <p>(60) Parent Application or Grant (63) Related by Continuation US Filed on 702,943 (CIP) 20 May 1991 (20.05.91)</p> <p>(71) Applicant (for all designated States except US): RMO, INC. [US/US]; 650 West Colfax Avenue, Denver, CO 80204 (US).</p> | | <p>(72) Inventors; and (75) Inventors/Applicants (for US only) : PETERSON, Jeffrey, A. [US/US]; 16266 East Hamilton Place, Aurora, CO 80013 (US). FRANSEEN, Steven, A. [US/US]; 10196 West Keen Avenue, Denver, CO 80235 (US).</p> <p>(74) Agents: MARSH, Thomas, R. et al.; Sheridan Ross & McIntosh, 1700 Lincoln Street, 35th Floor, Denver, CO 80203 (US).</p> <p>(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), MC (European patent), NL (European patent), SE (European patent), US.</p> | |
| <p>Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p> | | | |

(54) Title: IMPROVED EDGEWISE ORTHODONTIC BRACKET



(57) Abstract

An improved edgewise orthodontic bracket is disclosed. In one embodiment, a bracket (10) comprises a single pair of opposing T-shaped tie wings (12, 14) which define an archwire slot (18) therebetween. Notches (20) are provided on each of the mesial and distal sides of the center leg (28) of each T-shaped tie wing (12, 14) for selectively receiving a ligating device. The notches (20) are defined in the gingival/occlusal edges of the tie wings (12, 14) and comprise sloped portions (24) that extend labially towards the archwire slot (18). Convex sidewall portions (42) and convex floor portions (44) are provided in the archwire slot (18) adjacent to the notches (20). An auxiliary slot (30) may be centrally disposed under the center legs (28) of the opposing T-shaped tie wings (12, 14). Alternatively, twin auxiliary slots (80) may be disposed under the convex archwire slot floor portions (44). An integral T-shaped hook (50) may be provided as a cantilevered extension from the center leg (28) of one of the T-shaped tie wings (12, 14). Alternatively, twin auxiliary slots (80) may be disposed under the convex archwire slot floor portions (44). An integral T-shaped hook (50) may be provided as a cantilevered extension from the center leg (28) of one of the T-shaped tie wings (12, 14) for use in attachment of traction devices.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

| | | | | | |
|----|--------------------------|----|--|----|--------------------------|
| AT | Austria | FI | Finland | ML | Mali |
| AU | Australia | FR | France | MN | Mongolia |
| BB | Barbados | GA | Gabon | MR | Mauritania |
| BE | Belgium | GB | United Kingdom | MW | Malawi |
| BF | Burkina Faso | GN | Guinea | NL | Netherlands |
| BG | Bulgaria | GR | Greece | NO | Norway |
| BJ | Benin | HU | Hungary | PL | Poland |
| BR | Brazil | IE | Ireland | RO | Romania |
| CA | Canada | IT | Italy | RU | Russian Federation |
| CF | Central African Republic | JP | Japan | SD | Sudan |
| CG | Congo | KP | Democratic People's Republic of Korea | SE | Sweden |
| CH | Switzerland | KR | Republic of Korea | SN | Senegal |
| CI | Côte d'Ivoire | LI | Liechtenstein | SU | Soviet Union |
| CM | Cameroon | LK | Sri Lanka | TD | Chad |
| CS | Czechoslovakia | LU | Luxembourg | TG | Togo |
| DE | Germany | MC | Monaco | US | United States of America |
| DK | Denmark | MG | Madagascar | | |
| ES | Spain | | | | |

IMPROVED EDGEWISE ORTHODONTIC BRACKET

FIELD OF THE INVENTION

This invention generally relates to edgewise orthodontic brackets and, more particularly, to edgewise brackets having enhanced treatment, comfort and ease-of-use features, as well as increased modalities.

BACKGROUND OF THE INVENTION

Orthodontic brackets are widely used to align teeth through the application of forces selectively provided by interconnected archwires and accessories. Brackets are typically of metal, ceramic or composite construction and are interconnected to either bands or bonding pads for attachment to teeth.

In edgewise brackets, an archwire passes through a labially opening, horizontal slot defined by one or more pair of opposing tie wings. The archwire is pre-shaped and sized to provide the desired forces. In each bracket, a tie wing pair includes a gingivally extending tie wing and occlusally extending tie wing. Once placed in the slot of one or more pair of tie wings, an archwire is typically restricted therein by a ligating device such as a steel or elastomeric ligature.

As orthodontic treatment objectives and techniques continue to evolve, numerous corresponding edgewise bracket designs and interconnecting accessories have been proposed. Recently, it has been recognized that it is desirable to reduce frictional engagement between the archwire and

-2-

bracket surfaces defining the archwire slot to facilitate space closure and bodily tooth movement. Similarly, in many situations, it is now a goal to reduce frictional engagement between the archwire and ligating device
5 employed to restrict the archwire within the slot. Such friction reduction can markedly increase the rate of tooth movement and reduce the duration of the orthodontic treatment.

At the same time, patient comfort and ease-of-use
10 considerations have become increasingly important. Patient comfort has been largely addressed by reducing bracket size to yield smaller and more smoothly contoured bracket. Ease-of-use considerations have stimulated bracket designs which facilitate practitioner's bracket placement/use and
15 accommodate plural modalities.

The present invention represents significant advances in relation to the above-noted orthodontic bracket considerations, both singularly and combinatively, while maintaining the structural integrity of the bracket.

20

SUMMARY OF THE INVENTION

In one aspect of the present invention, an edgewise bracket is provided having a pair of tie wings defining an archwire slot therebetween, and a pair of ligating support means, one defined within the mesial/distal extent of each tie wing. The ligating support means may be selectively employed to reduce frictional engagement between an archwire positioned in the slot and a ligating device
25

-3-

positioned on the ligating support means and across the archwire slot. Each ligating support means includes a sloped, or angled, portion that extends labially toward the slot (e.g., labially from the gingival/occlusal periphery towards the slot), to reduce binding of a ligating device positioned thereupon. The ligating support means are preferably notches extending from the gingival or occlusal periphery of a tie wing, sized to readily receive a ligating device, and preferably having a curvilinear, concave configuration to further reduce binding. Typically, the opposing notches in a given pair of tie wings will have a common center axis which is parallel to the gingival-occlusal center axis of the bracket. When the archwire slot includes convex sidewall and/or floor portions to reduce archwire/bracket frictional engagement, the ligating support means are preferably disposed adjacent thereto (e.g., centered upon a common gingival-occlusal plane) for enhanced treatment control.

In another aspect of the present invention, an edgewise bracket is provided having a single pair of tie wings and two pairs of opposing ligating support means defined within the mesial/distal extent of the tie wings, one pair on each of the mesial and distal sides of the bracket. The gingival/occlusal extremes of the tie wings define an elliptical configuration when viewed labially. More particularly, each tie wing comprises central, mesial and distal portions which extend gingivally or occlusally, with ligating support means defined between the central and

-4-

mesial portions and between the central and distal portions, wherein the gingival/occlusal edges of such portions define an elliptical configuration. Such configuration accommodates size reduction, yielding patient
5 comfort benefits, while preserving structural integrity and performance.

In this regard, and as will become apparent, a single pair of opposing T-shaped tie wings is preferred. That is, the "caps" of the T-shaped tie wings define an archwire
10 slot therebetween, and the "center legs" of each tie wing extends gingivally or occlusally. The ligating support means are preferably notches defined on the gingival/occlusal periphery on both the mesial and distal sides of a center leg of each T-shaped tie wing. The
15 center legs each comprise a gingivally/occlusally extending cantilevered portion that can be conveniently employed as a stanchion for ligature interconnection. The mesial/distal tie wing tip portions on the outside of each notch also comprise gingivally/occlusally extending
20 cantilevered portions that extend a sufficient distance outward from the outer tie wing sidewalls to retain a ligating device in an arcuate seat formed under the cantilevered tie wing tip portions and center legs during conventional ligation. Relatedly, the cantilevered center
25 leg of each T-shaped tie wing should extend at least approximately the same distance outward beyond the outer gingival/occlusal extremes of the adjacent ligating support means so as to retain a ligating device when the ligating

-5-

support notches are selectively employed by a practitioner to support a ligating device.

In a further aspect of the present invention, an edgewise bracket is provided having a single pair of tie wings defining an archwire slot therebetween, and an integral T-shaped hook extending gingivally/occlusally from one tie wing, and in perpendicular relation to the longitudinal center axis of the archwire slot, wherein traction devices (e.g., rubber bands, springs, etc.) can be readily attached from a plurality of directions so as to accommodate plural modalities for treatment. The T-shaped hook is centered upon the gingival-occlusal center axis of the bracket, and is preferably provided as a cantilevered extension of the center leg of a T-shaped tie wing so as to communicate external face moments created by interconnected traction devices close to a tooth's root center of resistance. Preferably, the T-shaped hook is generally flat as viewed from the mesial and distal aspects. Further, as viewed from the labial aspect, the T-shaped hook preferably comprises a tapered portion contiguous to the center leg of the T-shaped tie wing, an arcuate neck portion contiguous thereto, and a head portion contiguous thereto the tapered portion, wherein a traction device may be reliably maintained in the neck portion. That is, the tapered portion serves to restrict movement of the traction device towards the archwire slot of the bracket, and the head portion serves to restrict disconnection of the traction device from the T-shaped hook. The integral T-

-6-

shaped hook preferably comprises a malleable material so as to allow for selective pivotal movement of the T-shaped hook as may be desirable for soft tissue clearance and patent comfort.

5 In yet another aspect of the present invention, an edgewise bracket is provided having at least one pair of tie wings defining an archwire slot therebetween, wherein when viewed from mesial/distal aspects, the gingivally/occlusally facing outer sidewalls of the tie
10 wing pair define a trapezoid. One outer sidewall is disposed at an angle relative to the longitudinal center plane of the archwire slot, wherein the sidewall extends labially away from such center plane. The other sidewall is disposed substantially parallel to the archwire slot
15 center plane. The angled sidewall is disposed gingivally in maxillary applications and occlusally in mandibular applications. By way of example, use of the described configuration allows for enhanced, early treatment of partially erupted upper bicuspids, wherein the archwire
20 slot will be acceptably, gingivally positioned upon full eruption of the bicuspid. This enhances treatment and reduces demands upon the practitioner time. Further, bracket systems of this design will generally reduce bracket/tooth contact between the upper and lower arches.
25 Bracket profile and strength can also be acceptably maintained using the described configuration.

In another aspect of the present invention, an edgewise bracket is provided having one tie wing pair

-7-

defining an archwire slot therebetween and at least one auxiliary slot extending from a gingival edge to the occlusal edge, or vice versa, wherein the slot and shaft of the auxiliary device to be inserted into the slot have
5 complimentary configurations to restrict rotational movement therebetween. By way of example, the auxiliary slot may have adjoining flat inner sidewalls (e.g., defining square corners), and the auxiliary shaft may have complimentary flat outer sidewalls (e.g., defining square
10 corners), wherein rotational movement therebetween is desirably restricted.

In a related aspect of the present invention, an edgewise bracket is provided having a single tie wing pair defining an archwire slot therebetween, at least one convex portion extending labially and transversely across the floor of the archwire slot, and at least one auxiliary slot extending gingivally/occlusally and positioned under the convex slot floor portion. By positioning the auxiliary slot under the convex slot floor portion, bracket height
15 can be advantageously conserved, and therefore reduced, so as to enhance patient comfort. When two convex slot floor portions are provided, one on each of the mesial/distal sides, twin auxiliary slots may be advantageously positioned so that one passes under each of the convex slot
20 floor portions. In addition to the above-noted advantages, this bracket yields significant tooth rotation capabilities. For example, in early treatment stages, the twin auxiliary slots can be utilized with a steel ligature
25

-8-

to achieve rapid gross tooth rotation. As can be appreciated, complementary auxiliary slot/auxiliary shaft configurations of the above-described nature can also be employed.

5 In one embodiment of the present invention, an edgewise bracket is provided having a single set of opposing T-shaped tie wings with ligating support notches defined on each side (i.e., mesially and distally) of the center leg of each tie wing. The sidewalls defining the
10 archwire slot are provided to present two sets of opposing convex sidewall portions, one set on each of the mesial and distal sides of the bracket. Similarly, the floor of the archwire slot is provided to present two convex portions extending labially and transversely across the slot, one on
15 each of the mesial and distal sides of the bracket. By virtue of this arrangement, the bracket yields desirable tooth rotation and alignment capabilities with reduced archwire/archwire slot frictional engagement and selectively reduced archwire/ligating device frictional
20 engagement. Further, this configuration defines a dynamic archwire slot, wherein the archwire is allowed to maintain a "memory" of its slot entry angle, as is now desirable. The notches each comprise a portion that extends labially outwardly from the gingival/occlusal periphery towards the
25 archwire slot and presents concave, curvilinear surfaces to reduce ligature binding. The gingival/occlusal edges of the center legs and wing tip portions of the opposing T-shaped tie wings define an elliptical configuration when

-9-

viewed labially so as to reduce bracket size and advance patient comfort/ appearance. All prominent edges exposed to soft tissue are preferably rounded for patient comfort.

An integral T-shaped hook of the above-described
5 nature may be optionally provided as a cantilevered gingival/occlusal extension of the center leg of either T-shaped tie wing. The T-shaped hook preferably comprises a malleable material and preferably comprises flat lingually and labially facing surfaces, wherein the hook can be
10 manually pivoted to a limited extent by a practitioner relative to the center leg of the tie wing.

An auxiliary slot may also be optionally provided and disposed within the gingival-occlusal center plane of the bracket, underlying the center leg portions of the opposing
15 T-shaped tie wings. Alternatively, twin auxiliary slots may be provided, one on each side of the gingival-occlusal center plane of the bracket (i.e., mesially and distally positioned), such slots passing under the mesial and the distal convex slot floor portions of the archwire slot.
20 Whether a single or twin auxiliary slot arrangement is provided, each slot preferably has an inner-configuration which will restrict rotation of complimentary auxiliaries inserted thereto, as described above.

The T-shaped tie wings of the bracket may also be
25 optionally defined so that the outer gingival/occlusal facing sidewalls of the tie wing pair define a trapezoid when viewed from the mesial or distal aspects. In particular, one of the outer sidewalls is disposed

-10-

angle relative to the longitudinal center plane of the archwire slot, and is perpendicular to the tie wing base surface or base/bottom surface of the bracket. The other outer sidewall is disposed in parallel relation to the
5 center plane of the archwire slot.

The center leg of each T-shaped tie wing may also be optionally disposed at an acute angle relative to the longitudinal center axis of the slot. Such angling may be desired in applications wherein the central axis of the
10 clinical crown is positioned at an acute angle relative to the occlusal plane in normal occlusion. Such angling correspondingly facilitates the practitioner's placement of the bracket on a tooth, wherein the axes of the center legs may be disposed along a tooth long axis, and wherein the
15 center axis of the bracket slot may be disposed parallel to the occlusal plane. Preferably, the mesial/distal facing edges of the center leg of each T-shaped tie wing are also parallel to the axes of the center legs to further facilitate accurate placement on a tooth. It is also
20 preferable for the center axes of opposing ligating support notches to be disposed parallel to the gingival-occlusal center plane of the bracket. Relatedly, for rotational purposes, it is preferable for the apices of the opposing convex slot sidewall portions and a convex slot floor
25 portion correspondingly positioned on the same mesial or distal side to lie within a common plane that is disposed substantially perpendicular to the longitudinal center plane of the archwire slot.

-11-

As will be appreciated by those skilled in the art, the embodiment of the invention described herein yields numerous advantageous features, yielding a new state-of-the-art bracket.

5

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1A-C illustrate labial, side and end views of one embodiment of the present invention;

10 Figs. 2A and 2B, and Figs. 2C and 2D, illustrate labial and end views of the embodiment of Figs. 1A-C when ligating support means are employed to support an elastomeric ligature and when ligating support means are not employed to support an elastomeric ligature, respectively;

15 Figs. 3A-C illustrate labial, side and end views of a modified version of said embodiment of the present invention having an integral T-shaped hook and twin auxiliary slots;

20 Figs. 4A-C illustrate labial, side and end views of a modified version of said embodiment of the present invention having outer tie wing sidewalls that define a trapezoid therebetween;

25 Figs. 5A-D illustrate labial, side and end views of the modified embodiment of the present invention illustrated in Figs. 4A-C, with a central auxiliary slot;

Figs. 6A-C illustrate labial, side and opposing end views of the modified embodiment of the present invention

-12-

illustrated in Figs. 4A-C, with an angulated gingival-occlusal center axis and twin auxiliary slots; and,

Figs. 7A-B illustrate two views of an exemplary auxiliary device useable with the auxiliary slots of the
5 present invention.

DETAILED DESCRIPTION

One embodiment of the edgewise bracket 10 of the present invention is illustrated in Figs. 1A-C and 2A-D,
10 with various modifications, modalities and an exemplary auxiliary reflected by Figs. 3A-C, 4A-C, 5A-C, 6A-C and 7A-B. Corresponding features are referenced by common reference numerals.

The edgewise bracket 10 comprises two integral,
15 opposing T-shaped tie wings 12 and 14 having a common base portion and base surface 16, and defining an archwire slot 18 therebetween. By way of example only, a flange 32 may be adjoined to the bracket 10 for subsequent attachment to a band. Alternatively, the bracket may be adjoined to a
20 bonding pad (not shown).

Two sets of opposing ligating support means 20 and 22, are provided, each set comprising a gingivally disposed notch and occlusally disposed notch on the gingival and occlusal edges of tie wings 12,14, respectively. Each
25 ligating support means has a sloped portion 24 and top land portion 26. The sloped portions 24 have concave, curvilinear surfaces.

-13-

Each of the T-shaped tie wings 12,14 comprises a cantilevered central leg portion 28 centered upon the gingival-occlusal center axis (lying within plane AA) of the bracket 10 and cantilevered mesial/distal wing tip portions 30, with the above-noted top land portions 26 integral therebetween. The gingival/occlusal extremes of the center leg 28 and mesial/distal wing tip portions 30 of the tie wings 12,14 define, from the labial aspect, an elliptical configuration E. In this regard, cantilevered wing tip portions 30 extend a sufficient distance d outward from the outer sidewalls 34, 36 of the tie wings 12, 14, respectively, to retain a ligating device in an arcuate seat 38 formed under the cantilevered tie wing tip portions 30 and center legs 28. Relatedly, the cantilevered center leg 28 of each T-shaped tie wing 12, 14, extends a distance f beyond the outer gingival/occlusal extreme of the ligating support means 20 adjacent thereto, such distance f being at least approximately as great as the distance d.

The sidewalls defining the archwire slot 18 comprise two sets of opposing convex portions 42 to reduce frictional engagement with an archwire. Similarly, the floor of archwire slot 18 is provided with two convex portions 44 extending transversely across the archwire slot 18 to reduce frictional engagement with an archwire. As illustrated in Figs. 1A-C, the ligating support means 20, convex slot sidewall portions 42, and convex slot floor portion 44 disposed on the same side of the gingival-

-14-

occlusal center plane AA may have a common center axis (lying within plane BB). As such, frictional engagement between an archwire and the slot walls and base, and between an archwire and ligating device supported on 5 ligating support means 20 occurs in a limited region about plane BB.

An optional auxiliary slot 70 may be provided to receive a complimentary auxiliary device, such as the exemplary auxiliary 74 illustrated in Figs. 7A and 7B. The 10 inner sidewalls of auxiliary slot 70 and interfacing shaft portion 76 of the exemplary auxiliary 74 are preferably configured to restrict rotational movement therebetween. As illustrated, a complimentary square-angled configuration may be employed. Additionally, the auxiliary 74 preferably 15 comprises an extending portion 78 having an outer configuration which will not fit into auxiliary slot 70, thereby facilitating placement and removal.

Figs. 2A-B illustrate the interface between an archwire X and elastomeric ligating device Y when both sets 20 of the ligating support means 20 of the embodiment of the present invention illustrated in Figs. 1A-C are utilized. Figs. 2C-D illustrate the interface between an archwire X and elastomeric ligating device Y when neither of the ligating support means 20 of such embodiment are utilized. 25 As will be appreciated by those in the art, there are different treatment situations where each of these modalities may be desired. Additionally, the provision of a set of ligating support means 20 on each of the mesial

-15-

and distal sides of the bracket 10 allows a practitioner to utilize one set but not the other, as may be desirable.

In Figs. 3A-C an integral T-shaped hook 50 is provided as an extension to the center leg 28 of one of the T-shaped tie wings 12. The T-shaped hook 50 preferably comprises flat lingual and labial surfaces (see Fig. 3C), and is preferably malleable to allow for pivotal movement relative to center leg 20. The T-shaped hook 50 preferably comprises a tapered portion 52, arcuate neck portion 54 and head portion 56, whereby retention of a traction device in neck portion 54 is enhanced.

Twin auxiliary slots 80 may be optionally provided for receipt of an auxiliary device, such as the exemplary auxiliary 74 shown in Figs. 7A-B. The twin auxiliary slots 80 are beneficially disposed under the convex slot floor portions 44. The configuration of slots 80 and exemplary auxiliary 74 may be as described above to restrict rotational movement therebetween and facilitate placement/removal.

Figs. 3A-C also illustrate optional saddles 60 which can be provided in the support landing portions 26 for receiving a ligating device. It is believed that such saddles 60 may be beneficial in certain early treatment situations for purposes of retaining an undersized archwire in the desired position for rotational purposes.

In Figs. 4A-D, the outer sidewall 34 of tie wing 12 and outer sidewall 36 of tie wing 14 define a trapezoid therebetween. Specifically outer side wall 34 is angled

-16-

relative to the longitudinal center plane CC of the archwire slot 18, and the outer tie wing sidewall 36 is disposed in parallel relation to the center plane CC of the archwire slot 18. By virtue of this arrangement, the outer
5 sidewall 34 may be, for example, advantageously disposed gingivally on partially erupted upper bicuspids. Further, bracket systems employed by this configuration will generally reduce bracket/tooth contact between upper and lower arches.

10 The modified embodiment illustrated in Figs. 4A-C is shown with additional features in Figs. 5A-C and 6A-C. In Figs. 5A-C, a central auxiliary slot 70 is provided. Figs 6A-C illustrate the inclusion of twin auxiliary slots 80 for receiving of auxiliary devices. The twin vertical
15 slots 80 are disposed so that each passes under one of the convex slot floor portions 44.

In the version shown in Figs. 6A-C, it should also be appreciated that the gingival-occlusal center axis of the bracket (lying within plane AA) can be disposed at an acute
20 angle relative to center axis of archwire slot 18 (lying within plane CC). More particularly, center legs 28 may be centered upon the gingival-occlusal center axis and may be provided with distal/mesial surfaces 84 which are parallel to the gingival-occlusal center axis thereby facilitating
25 placement of the bracket. In this modified version, it should be recognized that while the center plane BB of the ligating support means 20 is also disposed parallel to the gingival-occlusal center axis, the apices of the convex

-17-

slot sidewall portions 42 and convex slot floor portion on each of mesial and distal sides lie in a plane which is perpendicular to the archwire slot center plane CC. Relatedly, it should be appreciated that, when a T-shaped 5 hook is utilized (such as the T-shaped hook 50 illustrated in Figs. 3A-C above), the center axis thereof will be disposed perpendicularly to the center axis of the archwire slot 18 and at an angle relative to the gingival-occlusal center axis of the bracket 10.

10 The foregoing description of the present invention has been provided for purposes of illustration and description. This description is not intended to limit the invention and various modalities thereof. Variations, embodiments and modifications will be apparent to those skilled in the art 15 and are intended to be within the scope of the following claims.

-18-

What is claimed is:

1. An edgewise orthodontic bracket comprising:

gingival and occlusal tie wings defining an labially opening archwire slot therebetween, each of the gingival and occlusal tie wings having a mesial/distal extent; and,

5 a first set of gingival and occlusal ligating support means, the gingival ligating support means being disposed within the mesial/distal extent of said gingival tie wing and including a sloped portion extending labially toward the archwire slot, and the occlusal ligating support means
10 being disposed within the mesial/distal extent of said occlusal tie wing and including a sloped portion extending labially towards the archwire slot.

2. An edgewise orthodontic bracket as recited in Claim 1, wherein said gingival ligating support means further comprises a concave notch extending from a gingival edge of said gingival tie wing towards said archwire slot,
5 and wherein said occlusal ligating support means further comprises a concave notch extending from an occlusal edge of said occlusal tie wing toward said archwire slot.

3. An edgewise orthodontic bracket as recited in Claim 1, further comprising:

a second set of gingival and occlusal ligating support means; and,

5 said first set of gingival and occlusal ligating support means being disposed on a mesial side of said bracket, and said second set of gingival and occlusal

-19-

ligating support means being disposed on a distal side of said bracket.

4. An edgewise orthodontic bracket as recited in Claim 3, wherein:

said gingival tie wing further comprises a gingivally-extending center leg portion and gingivally-extending mesial and distal tie wing tip portions;

said occlusal tie wing further comprises an occlusally-extending center leg portion and occlusally-extending mesial and distal tie wing tip portions;

wherein gingival edges of said gingival tie wing and occlusal edges of said occlusal tie wing define an elliptical configuration.

5. An edgewise orthodontic bracket as recited in Claim 3, further comprising:

a first set of opposing convex sidewall portions and a first convex floor portion within said archwire slot, wherein said first set of convex sidewall portions and said first convex floor portion are positioned substantially between said gingival and occlusal ligating support means of said first set of ligating support means; and,

a second set of opposing convex sidewall portions and a second convex floor portion within said archwire slot, wherein said second set of convex sidewall portions and said second convex floor portion are positioned substantially between said gingival and occlusal ligating support means of said second set of ligating support means.

-20-

6. An edgewise orthodontic bracket comprising:
gingival and occlusal tie wings positioned in opposing
relation to define a labially opening archwire slot
therebetween;

5 said gingival tie wing having a gingivally-extending
center leg and integral, gingivally-extending mesial and
distal tie wing tip portions;

10 said occlusal tie wing having an occlusally-extending
center leg and integral, occlusally-extending mesial and
distal tie wing tip portions; and

a cantilevered, T-shaped hook extending from and
integral with the center leg portion of one of said
gingival and occlusal tie wings.

7. An edgewise orthodontic bracket as recited in
Claim 6, said T-shaped hook comprising:

5 a tapered portion contiguous with said center leg
portion of said one of said gingival and occlusal tie
wings;

a neck portion contiguous with said tapered portion;
and,

a head portion contiguous with said neck portion.

-21-

8. An edgewise orthodontic bracket comprising:
upper and lower tie wings defining a labially opening
archwire slot therebetween, said upper tie wing having an
outer sidewall extending labially away from a longitudinal
5 center plane of said archwire slot, said lower tie wing
having an outer sidewall extending substantially parallel
to said longitudinal center plane of the archwire slot,
wherein a trapezoidal configuration is defined between said
outer sidewalls.

-22-

9. An edgewise orthodontic bracket comprising:
gingival and occlusal tie wings define a labially
opening archwire slot therebetween, said archwire slot
having opposing sidewalls and an adjoining floor;

5 a first convex portion extending labially from said
floor and across said archwire slot; and,

a first auxiliary slot positioned under said convex
portion.

10. An edgewise orthodontic bracket as recited in
Claim 9, further comprising:

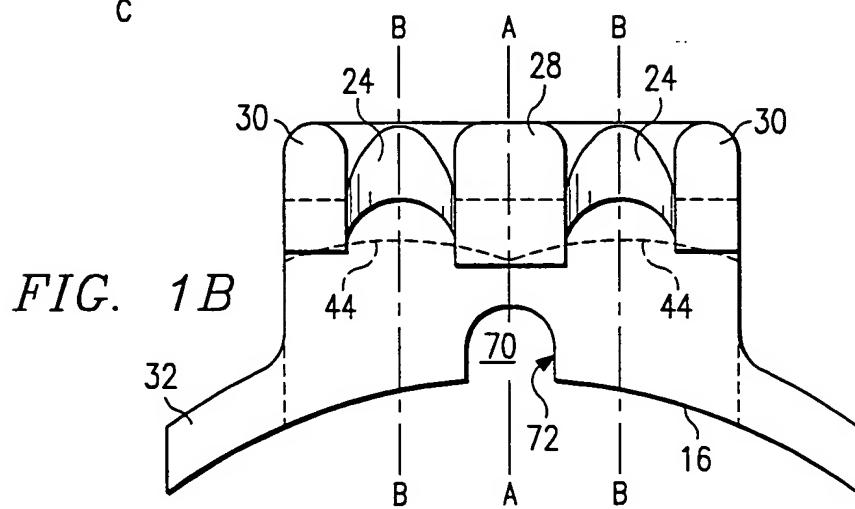
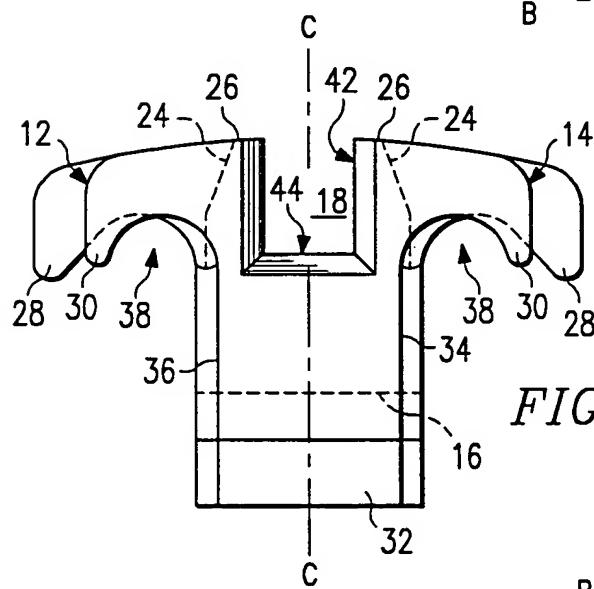
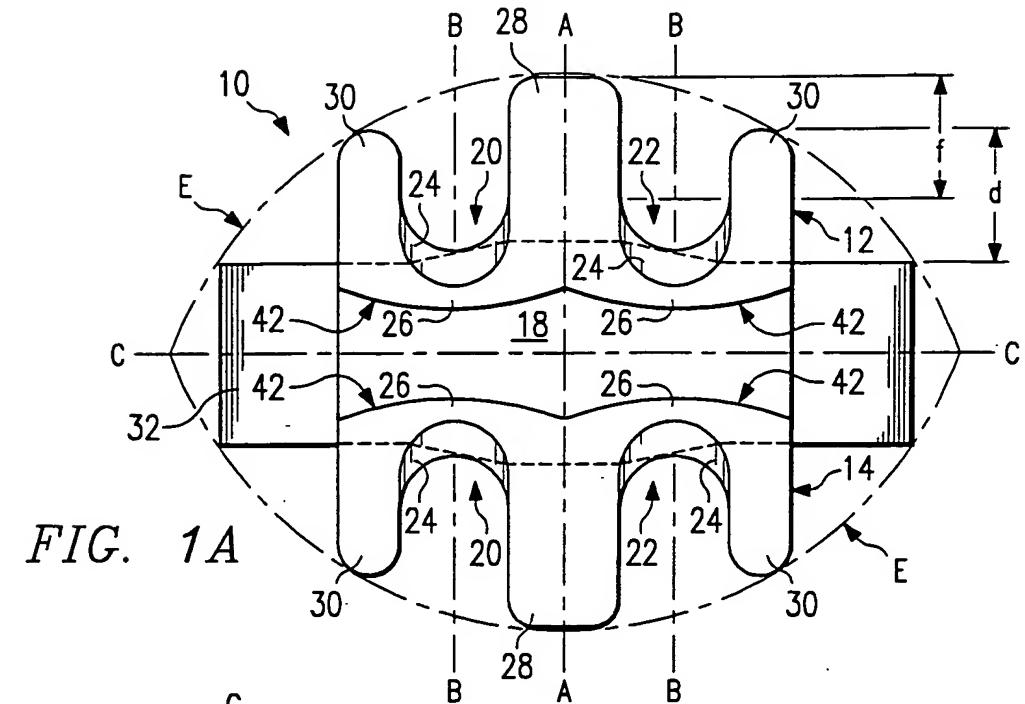
a second convex portion extending labially from said
floor and across said archwire slot; and,

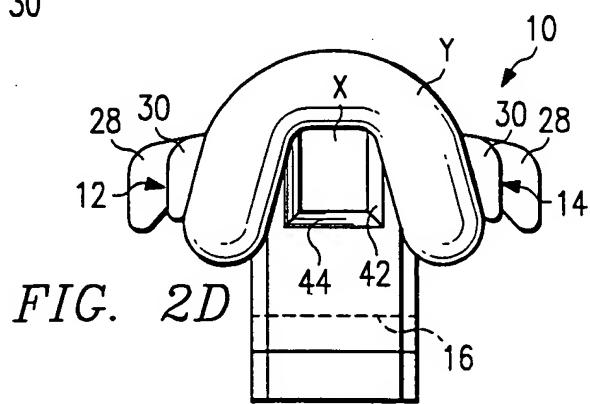
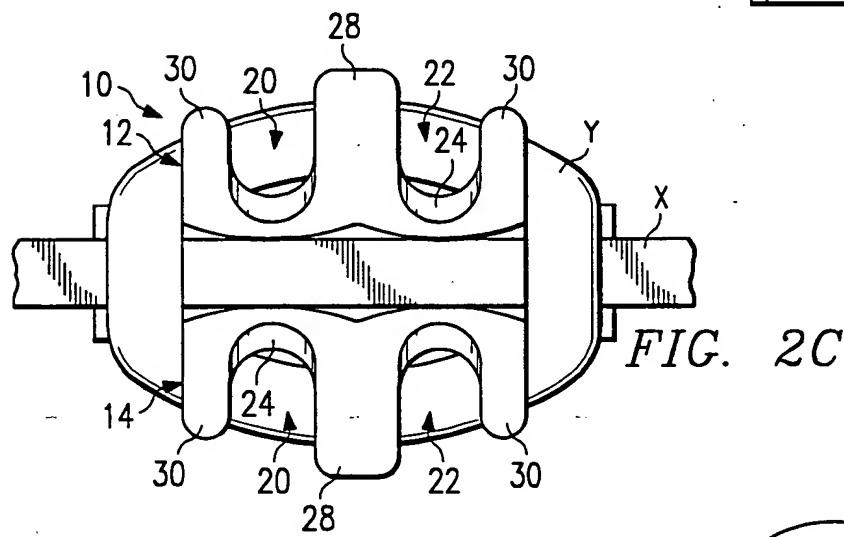
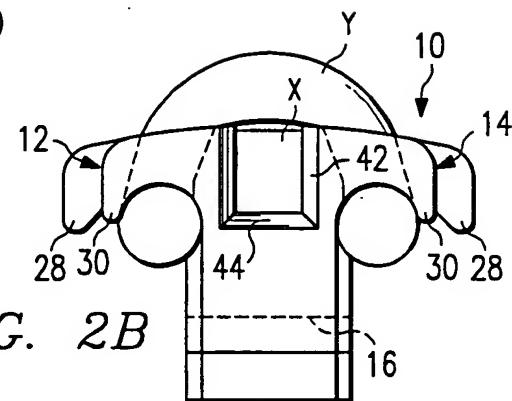
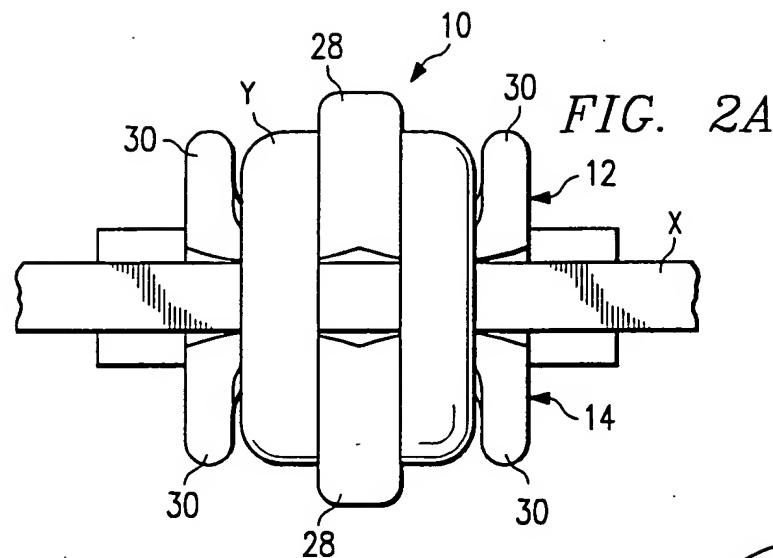
5 a second auxiliary slot positioned under said second
convex portion;

wherein said first convex portion and said first
auxiliary slot are located on a mesial side of said
bracket, and said second convex portion and said second
10 auxiliary slot are located on a distal side of said
bracket.

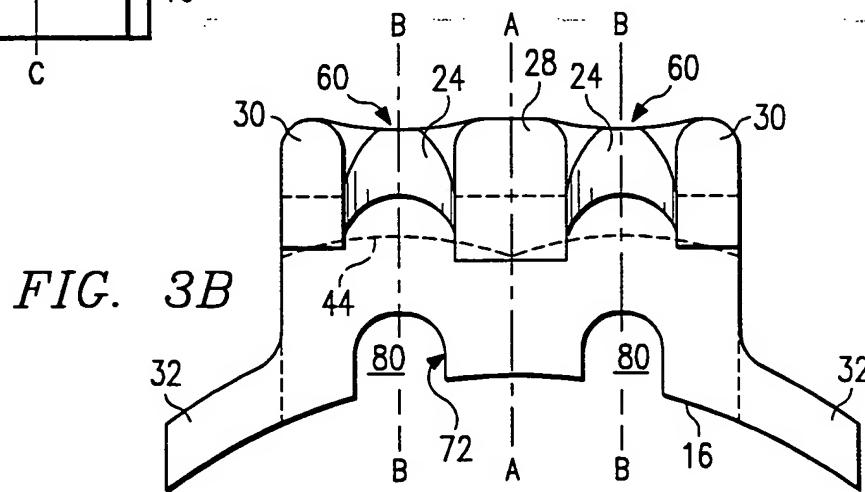
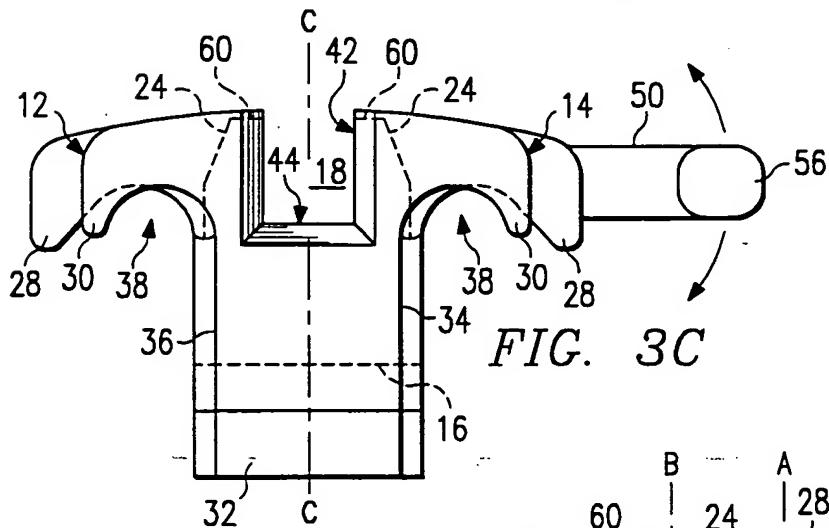
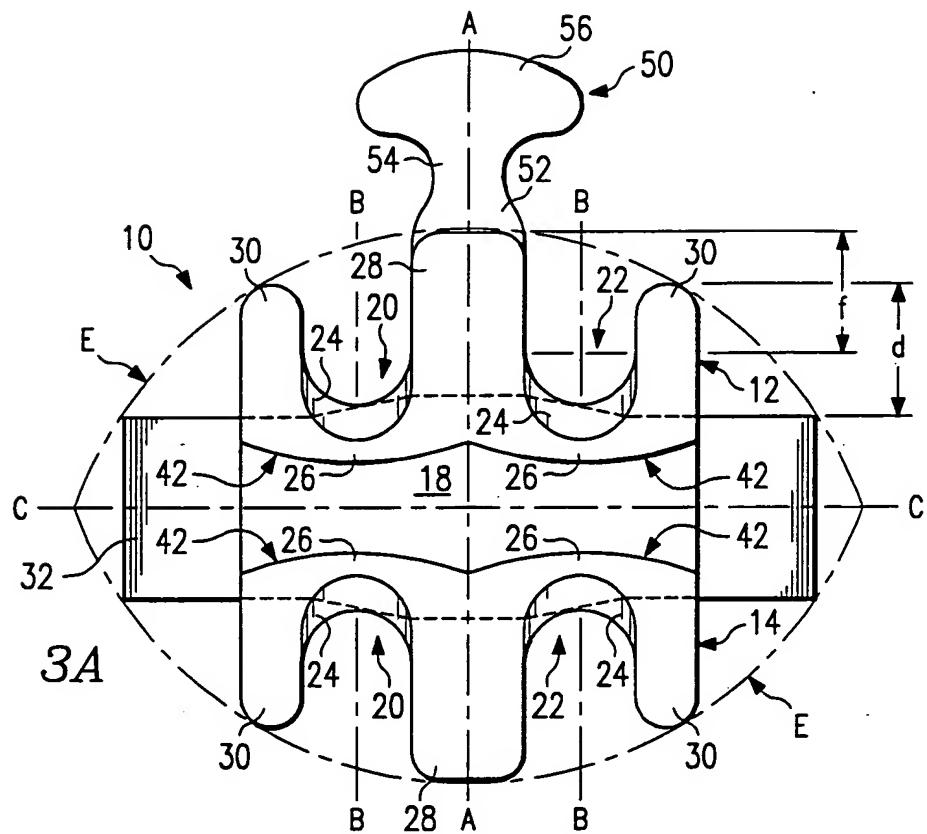
-23-

11. An edgewise orthodontic bracket comprising:
gingival and occlusal tie wings defining a labially
opening archwire slot therebetween;
an auxiliary slot extending from an outer sidewall of
5 said gingival tie wing to an outer side of said occlusal
tie wing; and,
an auxiliary device having a shaft portion
positionable within said auxiliary slot;
said auxiliary slot and said shaft portion of said
auxiliary device having complimentary configurations
10 wherein rotational movement therebetween is restricted.
12. An edgewise orthodontic bracket as recited in
Claim 11, wherein said auxiliary slot comprises adjoining,
flat sidewalls, and wherein said shaft portion of said
auxiliary device comprises complimentary adjoining, flat
5 outer sidewalls.

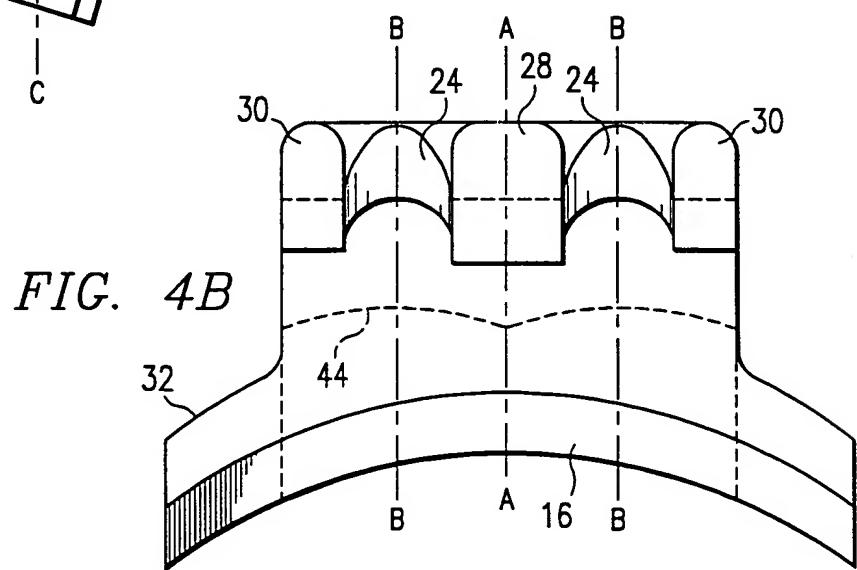
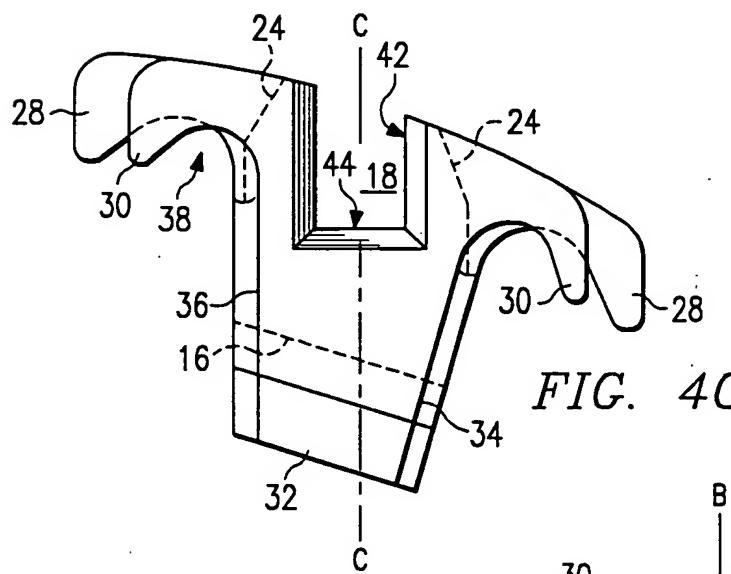
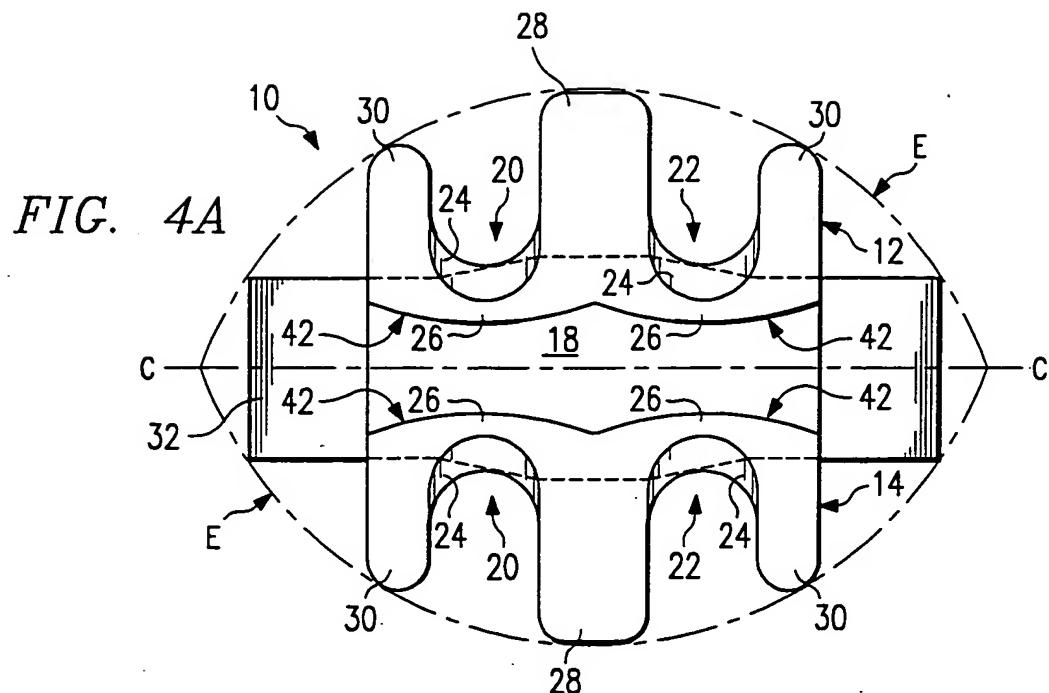




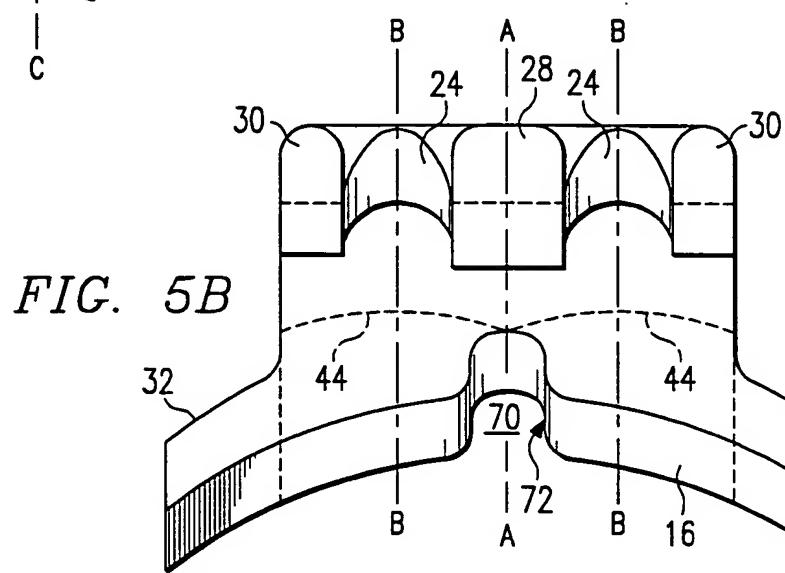
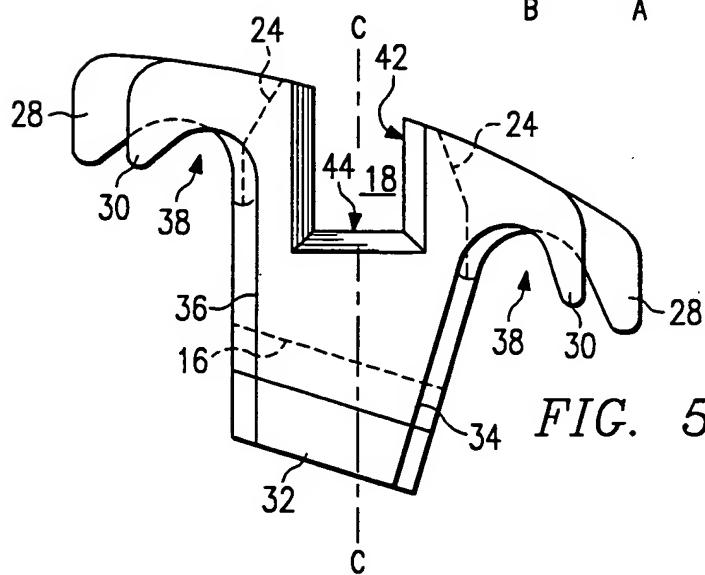
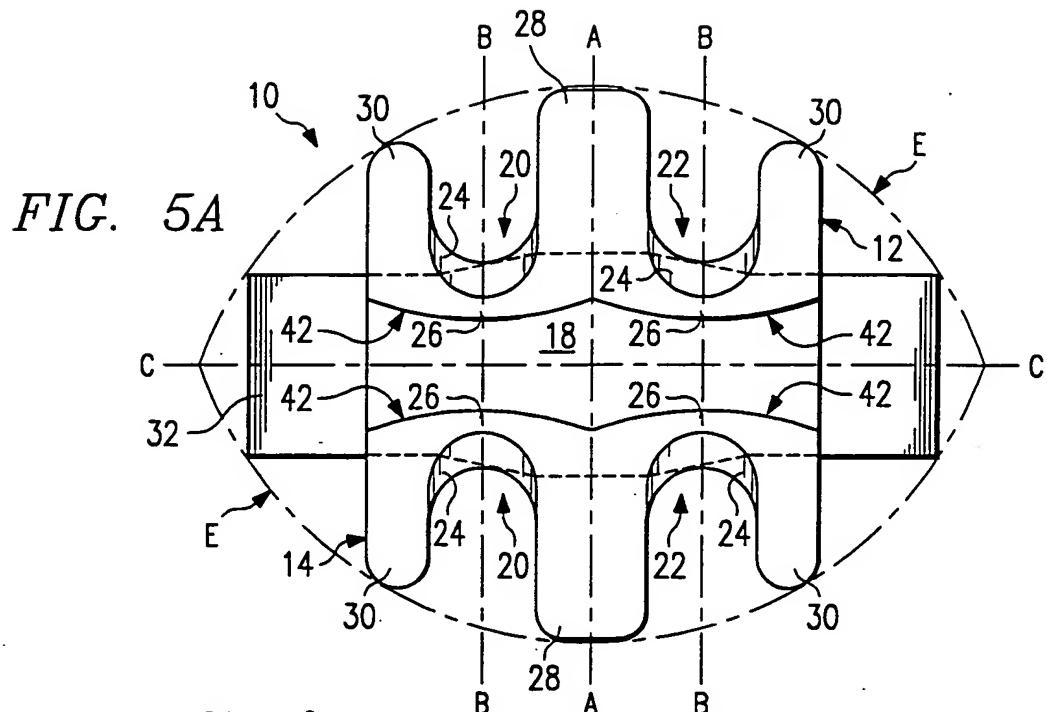
SUBSTITUTE SHEET



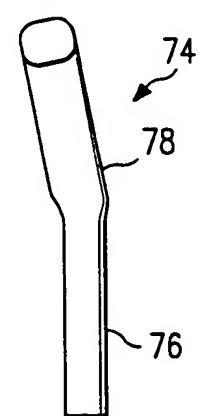
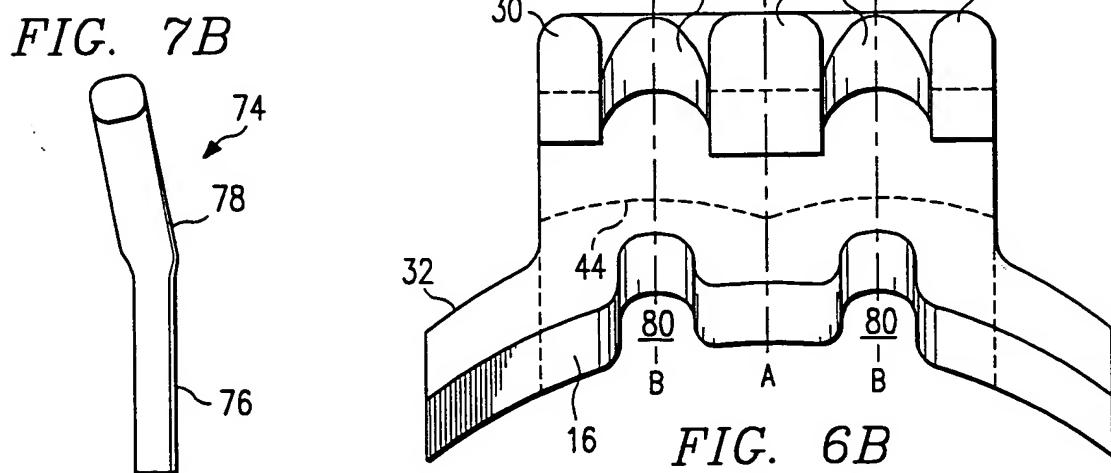
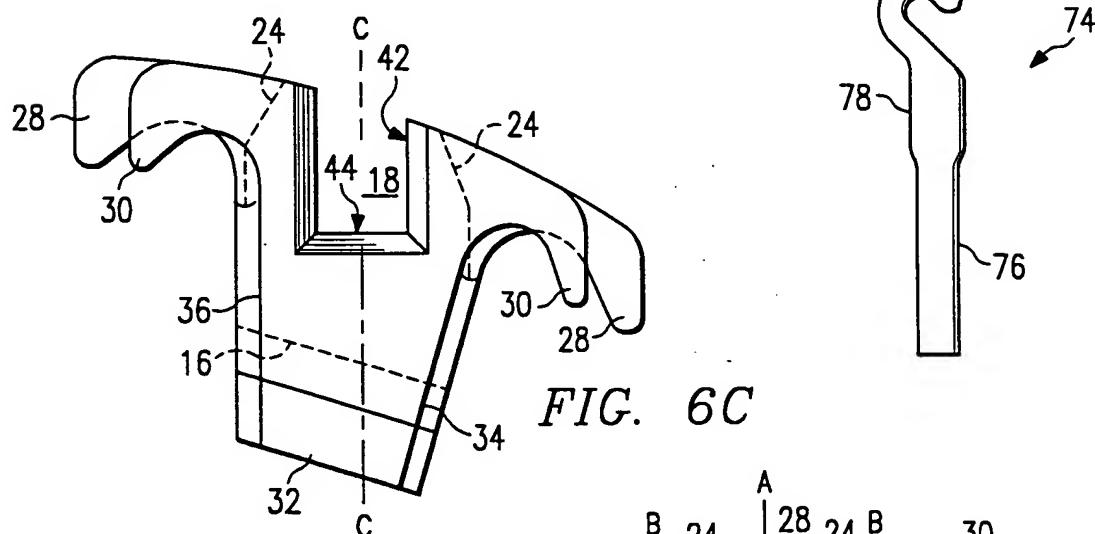
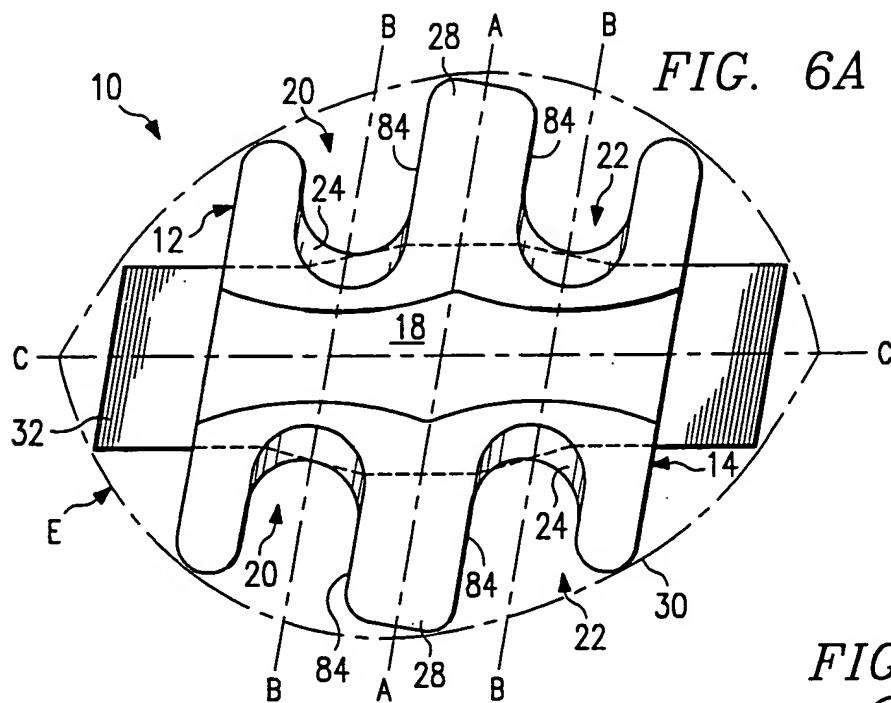
SUBSTITUTE SHEET



SUBSTITUTE SHEET



SUBSTITUTE SHEET



SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US92/04263

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) : A61C 3/00

US CL : 433/8

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 433/9,10,11,12,13,14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| X,P | US.A, 5,062,794 (MIURA) 05 NOVEMBER 1991 See figure 11, and column 7, line 49 to column 8, line 6. | 1-3 |
| Y | US.A, 4,799,882 (KESLING) 24 JANUARY 1989 See figure 10-12 and column 8, line 1 to column 9, line 14. | 6,7 |
| Y | US.A, 4,386,908 (KURZ) 07 JUNE 1983 See figs. 4 and 5. | 6,7 |
| Y,E | US.A, 5,127,828 (SUYAMA) 07 JULY 1992 See figure 4 and 6 | 9,10 |
| X Y | US.A, 4,859,179 (KESLING) 22 AUGUST 1989 See figure 3-5 | 11,12 9,10 |
| A | US.A, 4,529,975 (GHAFARI ET AL) 09 JULY 1985 See entire document. | 9-12 |

 Further documents are listed in the continuation of Box C. See patent family annex.

| | | | |
|-----|---|---|--|
| *A* | Special categories of cited documents: | T | later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
| *E* | document defining the general state of the art which is not considered to be part of particular relevance | X | document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
| *L* | earlier document published on or after the international filing date | Y | document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| *O* | document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | & | document member of the same patent family |
| *P* | document referring to an oral disclosure, use, exhibition or other means | | |
| | document published prior to the international filing date but later than the priority date claimed | | |

Date of the actual completion of the international search

27 JULY 1992

Date of mailing of the international search report

28 SEP 1992

Name and mailing address of the ISA/
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. NOT APPLICABLE

Authorized officer

CARY E. O'CONNOR

Telephone No. (703) 308-0858